Optical Counter-circulation-enhanced Phase Cancellation in Support of Novel Optical Processing Architecture

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Introduction

Thus far, optical processors have been used exclusively for specific computing functions and are not suitable for the sort of general functions for which conventional CPUs are relied upon.

Just as glass nanospheres may be used to reshape light into soliton energy for purposes of achieving photo-magnetic propulsion, these same glass nanospheres may be used in the realm of computing with a slight modification from the photo-magnetic propulsion configuration.

Abstract

Glass nanospheres have an intrinsic property which enables them to act as capacitors for light over picosecond timescales, provided that the polarity and angle of entry of the light may be controlled with sufficient precision. Just as semiconductor transistors retain an electrical charge over short timescales, light circulating within a nanosphere of glass may revolve repeatedly through the body of the sphere before ultimately exiting in along the path along which the light was originally traversing and onward toward the next optical transistor.

Rather than aiming for a head-on collision with the nanosphere as in the PoMP concept, the targeted point on the sphere would be halfway between one of the edges of the sphere and the center of the sphere. Provided that this level of control over light is possible, the glass nanospheres make the logical vehicle for a system of optical capacitance with computational efficacy.

A computational 'zero' or 'one' may be represented within such as system by way of the diminution of a portion of the light circulating in each nanosphere resulting from interaction (phase cancellation) of light due to its annihilation with light circulating in the opposite direction.

Light may be made to simultaneously strike the same nanosphere from directions offset by 90 degrees (transverse) whereas the light coming from direction A would be made to strike the right-hand portion of the sphere halfway between the center point and the right edge (from the light's perspective) and the light coming from direction B would strike the nanosphere on the left-hand portion (from the light's perspective) of the nanosphere halfway between the center point and the left edge.

Although Coulomb and magnetic forces exerted by light are relatively weak, phase cancellation is a substantial enough transmogrifying influence on light that, given sufficient opportunities for interaction between the counter-circulating light, non-trivial amplitude degradation would result while leaving intact sufficient light for a signal to continue on to subsequent optical transistors. If light is conveyed to the next set of transistors at full intensity, that may be termed a 'one.' If light is conveyed at a diminished intensity, that may be termed a 'zero.'

Transistor-based computing as it is currently understood depends upon the ability of a transistor to retain a transient property of decreased resistance for a useful length of time so as to alter the way in which it responds to subsequent inputs of voltage or, in this case, light.

This critical ingredient is provided for by the tendency of light entering at the proper angle to complete three or, perhaps, more circulations around each sphere, a process which transpires over picosecond timescales. In the time it takes for this circulation to transpire, impulses of light associated with a subsequent computational cycle may be injected into the spheres and interact with remnant light from the previous cycle, resulting in a diminution of the intensity of that light that is far less than that associated with two primary beams interacting within the interplay junctions (nanospheres) but which would be distinguishable from both primary interactions and non-interactions. It is in this way that a system based upon this design may be able to both distinguish between luminal impulses associated with various clock cycles as well as being able to distinguish computational 'zeroes' and 'ones.'

As much of the light associated with a beam would be scattered in directions other than the intended direction with passage through each transistor, a beam of a relatively high intensity would be needed at the outset of a clock cycle. The sensitivity and efficiency of light-to-electrical conversion mechanisms of the present SotA would likely be ample for making use of computational results, even after light as passed through a great many of these spheres. The final step in this process would naturally be the differentiation between two or more impulse amplitudes which could represent zero, one, as well as, perhaps, additional values. Optical counter-circulation-enhanced phase cancellation when provided the aforementioned prerequisites would form an ideal basis for a revolutionary optical processor design.

Depending upon how many revolutions around the interior of a glass nanosphere light makes and over what span of time (these spheres may be crafted in order to deliberately slow light in support of this end) it may be possible for remnant energy from a primary pulse to linger in a sphere for multiple computational cycles. If this is possible, it would be possible for such a system to support non-binary computation; a long sought-after feature of certain quantum computers that would improve performance.

Conclusion

It is likely that the primary strength of optical computing lies in its extremely high clock speed and low heat-generation. In a paradigm of application-specific processor design, it seems unlikely that any one processor design could be most efficient for all applications. For general computing, however, the ability to build optical processors capable of performing all of the functions of CPUs as they exist today would represent a sea change for the state of the art.